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ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 22: Specific conditions for ground based aeronautical mobile and fixed radio equipment; Harmonised Standard for ElectroMagnetic Compatibility

Reference

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.2] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

The present document is part 22 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document covers in respect of ElectroMagnetic Compatibility (EMC), the assessment of:

1) ground based aeronautical VHF radio communications equipment characterized by the following operating conditions:

    a) operating in the frequency range 118 MHz to 136,975 MHz, at 8,33 kHz or 25 kHz channel spacing;

    b) using DSB AM modulation;

2) ground-based UHF radio transmitters, receivers and transceivers for the UHF aeronautical mobile service characterized by the following operating conditions:

    a) operating in the frequency range 225 MHz to 399,975 MHz at 12,5 kHz or 25 kHz channel spacing;

    b) using DSB AM modulation;

3) VDL Mode 2 ground base station radio equipment operating in the frequency range 117,975 MHz to 137,000 MHz;

4) VDL Mode 4 ground base station radio equipment operating in the frequency range 112,000 MHz to 136,975 MHz.

NOTE: The relationship between the present document and essential requirements of article 3.1(b) of Directive 2014/53/EU [i.1] is given in Annex A.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI EN 301 489-1 (V2.2.3) (11-2019): "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility".

[2] ETSI EN 301 841-1 (V1.4.1) (04-2015): "VHF air-ground Digital Link (VDL) Mode 2; Technical characteristics and methods of measurement for ground-based equipment; Part 1: Physical layer and MAC sub-layer".

[3] ETSI EN 301 842-1 (V1.4.1) (04-2015): "VHF air-ground Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for ground-based equipment; Part 1: EN for ground equipment".

[4] ETSI EN 300 676-1 (V1.5.2) (03-2011): "Ground-based VHF hand-held, mobile and fixed radio transmitters, receivers and transceivers for the VHF aeronautical mobile service using amplitude modulation; Part 1: Technical characteristics and methods of measurement".

[5] ETSI EN 302 617 (V2.3.1) (07-2018): "Ground-based UHF radio transmitters, receivers and transceivers for the UHF aeronautical mobile service using amplitude modulation; Harmonised Standard for access to radio spectrum".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

[i.2] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

[i.3] ITU Radio Regulations (2016).

[i.4] Recommendation ITU-T P.53: "Psophometer for use on telephone-type circuits".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI EN 301 489-1 [1] and the following apply:

base station: aeronautical radio equipment, used in the aeronautical mobile service, for use with an external antenna and intended for use at a fixed location

centre frequency (Fc): centre of the transmitter necessary bandwidth

integral antenna equipment: radio communications equipment with an antenna integrated into the equipment without the use of an external connector and considered to be part of the equipment

necessary bandwidth: for a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions

NOTE: This is the definition in the ITU Radio Regulations, clause 146 [i.3].

occupied bandwidth: width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage ß/2 of the total mean power of a given emission

NOTE: Unless otherwise specified by ITU-R for the appropriate class of emission, the value of ß/2 should be taken as 0,5 % as defined in the ITU Radio Regulations [i.3].

operating frequency range: range(s) of continuous radio frequencies covered by the Equipment Under Test (EUT)

product standard: functional standard describing frequency management parameters of radio product

simplex: instantaneous one-way communications link

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AC	Alternating Current
AM	Amplitude Modulation
BER	Bit Error Ratio
BW	BandWidth
DC	Direct Current
DSB	Double Side Band full carrier
EM	ElectroMagnetic
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test
Fc	centre frequency
MPL	Minimum Performance Levels
RF	Radio Frequency
rms	root mean of squares
SINAD	Signal In Noise And Distortion
THD	Total Harmonic Distortion
UHF	Ultra High Frequency
VDL	VHF Digital Link
VHF	Very High Frequency

4 Test conditions

4.1 General

The test configuration and mode of operation shall represent the intended use and shall be recorded in the test report.

4.2 Arrangements for test signals

4.2.0 General

The provisions of ETSI EN 301 489-1 [1], clause 4.2 shall apply with the following modification:

- For integral antenna radio communications equipment a temporary 50 Ω RF connection point may be provided for connection to the measuring equipment.

4.2.1 Arrangement for test signals at the input to the transmitter

The provisions of ETSI EN 301 489-1 [1], clause 4.2.1 shall apply with the following modification:

- The transmitter shall be modulated with normal test modulation by an internal or external signal source capable of producing the appropriate drive signal (see clause 4.5).

4.2.2 Arrangements for test signals at the output from the transmitter

The provisions of ETSI EN 301 489-1 [1], clause 4.2.2 shall apply with the following modifications:

- The transmitter shall be operated at its maximum rated RF carrier output. If the maximum power cannot be maintained due to thermal limitations, any tests should be paused and the transmitter allowed to cool, until full power can be maintained again.
- The RF output signal of the transmitter shall be coupled to the measuring equipment via a shielded transmission line such as a coaxial cable. The measuring equipment shall comprise a combination of a modulation analyser and an audio distortion meter.

4.2.3 Arrangements for test signals at the input to the receiver

The provisions of ETSI EN 301 489-1 [1], clause 4.2.3 shall apply with the following modifications:

- The wanted RF input signal coupled to the receiver shall be modulated with normal test modulation (see clause 4.5).

4.2.4 Arrangements for test signals at the output from the receiver

The provisions of ETSI EN 301 489-1 [1], clause 4.2.4 shall apply.

4.2.5 Arrangements for testing transmitters and receivers together (as a system)

The provisions of ETSI EN 301 489-1 [1], clause 4.2.5 shall apply.

4.3 RF exclusion band for radio communications equipment

4.3.1 General

Frequencies on which radio communications equipment is intended to operate are excluded from immunity tests with radiated RF test signals.

The provisions of ETSI EN 301 489-1 [1], clause 4.3 shall apply with the following modifications:

- The transmitter exclusion bands and the receiver exclusion bands as defined in clauses 4.3.2 to 4.3.5 shall apply.

4.3.2 Transmitter exclusion bands for EM emission measurements

Exclusion bands shall apply when measuring transmitters in transmit mode of operation.

Exclusion bands shall not apply when measuring transmitters in standby mode of operation.

The exclusion bands for transmitters are given in table 1.

Table 1: Transmitter exclusion bands for emission measurements

Category of EUT (Channel spacing)	Width of exclusion band (see notes 1 and 2)	Centre of exclusion band
8,33 kHz	2,042 MHz or 2,442 MHz	Fc
12,5 kHz	2,063 MHz or 2,463 MHz	Fc
25 kHz equipment	2,125 MHz or 2,525 MHz	Fc
NOTE 1: The exclusion band is the product of 5 times the channel spacing plus 20 times the measurement bandwidth (i.e. 100 kHz or 120 kHz), for the measurement range 30 MHz to 1 GHz.		
NOTE 2: The extension of the exclusion bandwidth for transmitters to include 20 times the measurement bandwidth is needed to accommodate the skirt bandwidth of the filters used in the measurement equipment. A narrower measurement bandwidth may be used. The exclusion band and measurement bandwidth shall be recorded in the test report.		

4.3.3 Receiver exclusion bands for EM emission measurements

There shall be no frequency exclusion band applied to EM emission measurements of receivers.

4.3.4 Transmitter exclusion bands for immunity tests

The exclusion band extends plus and minus twice the occupied BandWidth (BW) from the centre frequency (Fc ± 2 BW).

For 25 kHz equipment the exclusion band extends ±50 kHz, for 8,33 kHz equipment ±16,7 kHz and for 12,5 kHz equipment ±25 kHz around the centre frequency (Fc).

4.3.5 Receiver exclusion bands for immunity tests

The exclusion band is the operating frequency range, extended at each end by ± 5 % of the centre frequency (Fc).

EXAMPLE: For the equipment intended to operate in the frequency band 118 MHz to 136,975 MHz, the exclusion band extends from 111,625 MHz (i.e. 118 MHz minus (127,5 times 0,05) MHz) to 143,35 MHz (i.e. 136,975 MHz plus (127,5 times 0,05) MHz).

For the equipment intended to operate in the frequency band 225 MHz to 399,975 MHz, the exclusion band extends from 209,375 MHz (i.e. 225 MHz minus (312,5 times 0,05) MHz) to 415,600 MHz (i.e. 399,975 MHz plus (312,5 times 0,05) MHz).

4.4 Narrow band responses of receivers

Responses on receivers or the receiver part of transceivers occurring during the immunity tests at discrete frequencies which are narrow band responses (spurious responses), are identified by the following method.

If during immunity RF test the RF test signal (see ETSI EN 301 489-1 [1], clauses 9.2 and 9.5) causes non-compliance of the receiver, it is necessary to evaluate whether this non-compliance is due to a narrow band response or a wideband phenomenon. Therefore, the frequency of the test signal is increased by an amount equal to twice the nominal 6 dB bandwidth of the IF filter immediately preceding the demodulator of the receiver, or if appropriate, the bandwidth over which the equipment is intended to operate. The test is repeated with the frequency of the test signal decreased by the same amount.

If the receiver is then in either or both frequency offset cases in compliance with the specified performance criteria, the response is considered as a narrow band response.

If the receiver still does not comply with the specified performance criteria, this may be due to the fact that the offset has made the frequency of the unwanted signal correspond to the frequency of another narrow band response. Under these circumstances the procedure is repeated with an increase and decrease of the frequency of the test signal adjusted two and a half times the bandwidth referred to above.

If the receiver still does not comply with the specified performance criteria in either or both frequency offset cases, the phenomena is considered wide band and therefore an EMC problem and the equipment fails the test.